

Claims:

1. A filter comprising a reagent consisting essentially of at least one reactive functional group covalently bonded to a non-volatile inorganic substrate wherein the reagent chemically reacts with a gaseous component of a gas stream to remove the gaseous component from the gas stream.
2. The filter according to claim 1, wherein the reagent comprises a coating on a filter element or a coating on a strand of fibrous material forming a filter element or particles such as silica gel or a shaped article.
3. The filter according to claim 1, wherein the functional group is an aminopropylsilyl group such as a 3-aminopropylsilyl group or a N-[2-aminoethyl]-3-aminopropylsilyl group or a N-[3-aminoethyl]-3-aminopropylsilyl group or a N-[N-(2-aminoethyl)-2-aminoethyl]-3-aminopropylsilyl group.
4. The filter according to claim 1, wherein the substrate comprises filter fibers and the reagent is covalently bonded to the filter fibers preferably in an amount of 10 to 50% by weight.
5. The filter according to claim 1, wherein the gaseous component to be removed is polar such as an aldehyde.
6. The filter according to claim 1, wherein the reagent is incorporated in filter paper optionally arranged as adjacent layers in the filter or folded into a three-dimensional shape or arranged as a single layer in the filter.
7. The filter according to claim 1, wherein the reagent is incorporated with cellulose acetate fibers and/or polypropylene fibers.

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8. The filter according to claim 1, wherein the reagent is incorporated in a cavity of the filter or the reagent is incorporated in a carpet or drapery material.

9. The filter according to claim 1, wherein the filter comprises a replaceable filter element of an air ventilation system.

5 10. A filter which comprises an amino-modified silica gel wherein the functional group is an aminopropylsilyl group or an aminopropylsilyl group further substituted on nitrogen by one or more aminoalkyl or poly(aminoalkyl) functional groups.

10 11. The filter according to claim 10, wherein the filter is incorporated in an air ventilation system.

12. The filter according to claim 11, wherein amino-modified silica gel comprises an aminopropylsilyl group covalently bonded to the silica gel.

15 13. The filter according to claim 12, wherein the functional group includes a 3-aminopropylsilyl group or a N-[2-aminoethyl]-3-aminopropylsilyl group or a N-[3-aminoethyl]-3-aminopropylsilyl group or a N-[N-(2-aminoethyl)-2-aminoethyl]-3-aminopropylsilyl group.

14. The filter according to claim 10, wherein the amino-modified silica gel comprises a coating on a filter element or a coating on a strand of fibrous material forming a filter element or particles such as silica gel or a shaped article.

20 15. The filter according to claim 10, wherein the amino-modified silica gel is incorporated in filter paper optionally arranged as adjacent layers in the filter or folded into a three-dimensional shape or arranged as a single layer in the filter.

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16. The filter according to claim 10, wherein the amino-modified silica gel is incorporated with cellulose acetate fibers and/or polypropylene fibers.

17. The filter according to claim 10, wherein the amino-modified silica gel is incorporated in a cavity of the filter or the reagent is incorporated in a carpet or  
5 drapery material.

18. The filter according to claim 10, wherein the filter comprises a replaceable filter element of an air ventilation system.

19. The filter according to claim 10, wherein the amino-modified silica gel has an average particle diameter of at least 10  $\mu\text{m}$  or the amino-modified silica gel is  
10 in the form of particles having a mesh size of at least 60.

20. The filter according to claim 10, wherein the total nitrogen content of the amino-modified silica gel is in the range of approximately 1 to 3 percent by weight, preferably 1.5 to 2.1 percent by weight.

21. A method of manufacturing a filter which is useful for removing a gaseous component of a gas mixture, comprising steps of:  
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preparing a reagent comprising at least one reactive functional group covalently bonded to a non-volatile inorganic substrate; and

incorporating the reagent in a filter wherein the reagent chemically reacts with a gaseous component of a gas mixture to remove the gaseous component  
20 from the gas mixture.

22. The method according to claim 21, wherein the reagent is effective in removing a polar gaseous component such as an aldehyde from the gas mixture.

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23. The method according to claim 21, wherein the reagent is prepared such that the functional group includes a 3-aminopropylsilyl group or a N-[2-aminoethyl]-3-aminopropylsilyl group or a N-[3-aminoethyl]-3-aminopropylsilyl group or a N-[N-(2-aminoethyl)-2-aminoethyl]-3-aminopropylsilyl group.

5 24. The method according to claim 23, wherein the reagent is prepared by reacting silica gel with an aqueous or non-aqueous solution containing 3-aminopropyltriethoxysilane or 3-aminopropyltrimethoxysilane or N-[3-(trimethoxysilyl)propyl]-ethylenediamine or N<sup>1</sup>-[3-(trimethoxysilyl)propyl]-diethylenetriamine.

10 25. The method according to claim 21, wherein the functional group is an aminopropylsilyl group such as a 3-aminopropylsilyl group.

26. The method according to claim 21, wherein the reagent is incorporated in the filter by coating the reagent on a filter element or coating the reagent on a strand of fibrous material forming a filter element.

15 27. The method according to claim 21, wherein the substrate comprises filter fibers and the reagent is covalently bonded to the filter fibers preferably in an amount of 10 to 50% by weight.

20 28. The method according to claim 21, wherein the reagent is incorporated in filter paper optionally arranged as adjacent layers in the filter or folded into a three-dimensional shape or arranged as a single layer in the filter.

29. The method according to claim 21, wherein the reagent is incorporated with cellulose acetate fibers and/or polypropylene fibers.

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30. The method according to claim 21, wherein the reagent is incorporated in a cavity of the filter or the reagent is incorporated in a carpet or drapery material.

31. The method according to claim 21, wherein the filter comprises a replaceable filter element of an air ventilation system.

5 32. The method according to claim 21, wherein the reagent comprises amino-modified silica gel having an average particle diameter of at least 10  $\mu\text{m}$  or the reagent comprises amino-modified silica gel in the form of particles having a mesh size of at least 60.

10 33. The method according to claim 32, wherein the total nitrogen content of the amino-modified silica gel is in the range of approximately 1 to 3 percent by weight, preferably 1.5 to 2.1 percent by weight.

15 34. A method of removing a gaseous component of a gas mixture, comprising passing the gas mixture in contact with a filter comprising a reagent comprising at least one reactive functional group covalently bonded to a non-volatile inorganic substrate such that the reagent chemically reacts with the gaseous component of the gas mixture and removes the gaseous component from the gas mixture.

20 35. The method according to claim 34, further comprising steps of generating the gas mixture and directing a gas stream containing the gas mixture into contact with the filter such that the component of the gas mixture to be removed is chemically reacted with the reagent and prevented from reentering the gas stream.

36. The method according to claim 34, wherein the functional group is an aminopropylsilyl group effective to remove an aldehyde component from the gas

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mixture, the gas mixture being passed into contact with the reagent such that the aldehyde component is removed from the gas mixture.

37. The method according to claim 34, wherein the functional group is a 3-aminopropylsilyl group effective to remove formaldehyde from the gas mixture, the gas mixture being passed into contact with the reagent such that the formaldehyde is removed from the gas mixture.

38. The method according to claim 34, wherein the reagent comprises amino-modified silica gel located in one or more filter elements, the gas mixture being passed into contact with the one or more filter elements.

39. The method according to claim 34, wherein the substrate comprises particles or a shaped article, the gas mixture being passed into contact with a mass of the particles or into contact with the shaped article.

40. The method according to claim 34, wherein the reagent is incorporated in filter paper optionally formed into a three-dimensional shape or the reagent is combined with fibers which are formed into a filter element, the gas mixture being passed into contact with the filter paper or the filter element.

41. The method according to claim 34, wherein the reagent is combined with an air permeable filter body, the gas mixture being passed into contact with the filter body such that the reagent chemically reacts with the gaseous component and removes the gaseous component from the gas mixture.

42. The method according to claim 34, wherein the substrate comprises filter fibers such as polypropylene and/or cellulose acetate fibers and the reagent is covalently bonded to the filter fibers in an amount of 10 to 50% by weight, the

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gas mixture being passed into contact with the filter fibers such that the gaseous component reacts with the reagent and the gaseous component is removed from the gas mixture.

5 43. The method according to claim 34, wherein the functional group includes a 3-aminopropylsilyl group or a N-[2-aminoethyl]-3-aminopropylsilyl group or a N-[3-aminoethyl]-3-aminopropylsilyl group or a N-[N-(2-aminoethyl)-2-aminoethyl]-3-aminopropylsilyl group, the gas mixture being passed into contact with the reagent.

10 44. The method according to claim 34, wherein the reagent comprises amino-modified silica gel having a total nitrogen content in the range of approximately 1 to 3 percent by weight, preferably 1.5 to 2.1 percent by weight, the gas mixture being passed into contact with the reagent.

15 45. The method according to claim 34, wherein the reagent is incorporated in a cavity of the filter or the reagent is incorporated in a carpet or drapery material, the gas mixture being passed into contact with the reagent.

46. The method according to claim 34, wherein the filter comprises a replaceable filter element of an air ventilation system, the gas mixture comprising ambient air passed into contact with the filter element.

20 47. The method according to claim 34, wherein the reagent comprises amino-modified silica gel having an average particle diameter of at least 10  $\mu\text{m}$  or amino-modified silica gel in the form of particles having a mesh size of at least 60, the gas mixture being passed into contact with the reagent.

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